22531

Instructions –   (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1.   **Attempt any <u>FIVE</u> of the following:**   **10**

a) Name any two types of PLC Counter instruction.

b) Define : Delay time and setting time.

c) Give two examples of manmade closed loop control system.

d) Compare Modular PLC and Fixed PLC on any two parameters.

e) The transfer function of a system is given by

$$\frac{C(S)}{R(S)} = \frac{10(S + 8)}{S(S + 4)}$$

Obtain its

i)   Poles

ii)   Zeroes

f) Give any two application of Servo System.

g) State the mathematical expression and principle of proportional control action.

Marks

2. **Attempt any THREE of the following:** **12**

a) Define transfer function. Derive an expression for transfer function of simple form of closed loop system.

b) Illustrate proportional - Integral - Derivative control (PID) action with output equation and nature of output response.

c) Describe sinking and sourcing concept in DC input modules of PLC.

d) Draw the functional block diagram of PLC and state the function of each block.

3. **Attempt any THREE of the following:** **12**

a) For a system with characteristics equation
$S^5+4S^4+10S^2+5S+24 = 0$, Examine the stability by Routh's stability criterion.

b) State four points of information associated with a timer instruction of PLC.

c) Give importance of PLC in automation.

d) Draw and describe Neutral zone in ON-OFF controller mode.

Marks

4. Attempt any <u>THREE</u> of the following: **12**

a) State the names and uses of input and output devices that can be interfaced with PLCs.

b) Plot a graph of Proportional-Integral (PI) controller mode output as a function of time for the given error in Fig. No. 1.

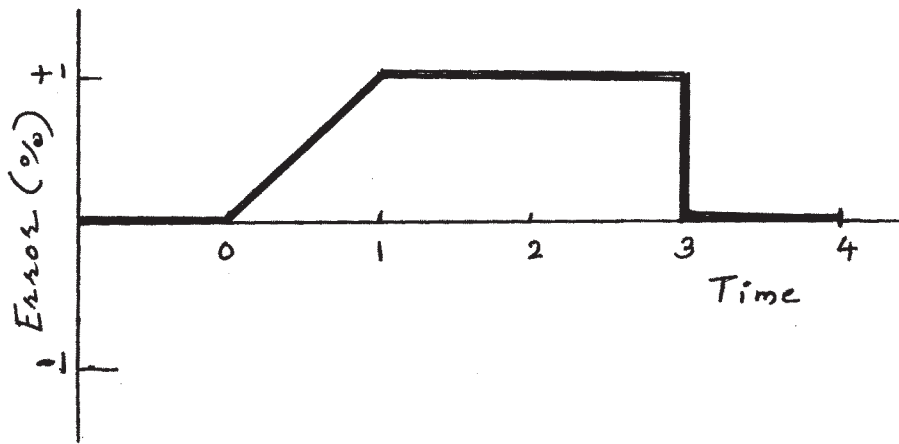$K_p = 5$, $K_I = 1.0$, S^{-1} and $P_I(0) = 20\%$

<u>Fig. No. 1</u>

c) Define damping. Draw time response of under damped system and over damped system.

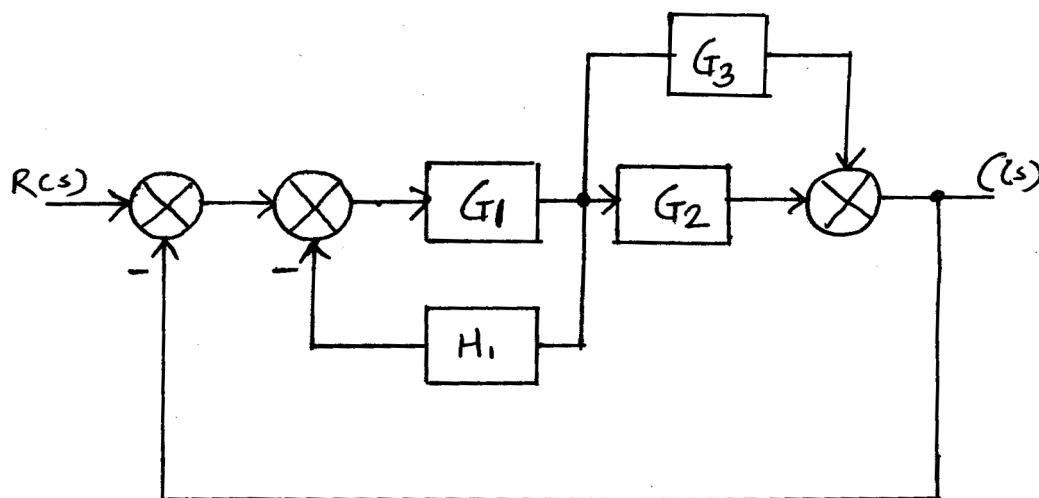d) Obtain transfer function for the system given in Fig. No. 2, using block diagram reduction technique.

<u>Fig. No. 2</u>

e) Draw and describe the block diagram of AC discrete input module of PLC.

P.T.O.

Marks

5. **Attempt any TWO of the following:** **12**

a) For a unity feedback system having open loop transfer function

$$G(S) = \frac{10(S + 1)}{S(S^3 + 12S^2 + 20S)}$$

Determine

i) Type of system

ii) Error constant K_p, K_v and K_a

b) With respect to PLC

i) Draw PLC scan cycle

ii) Describe memory organization of PLC

c) Draw the ladder diagram to verify : OR gate, AND gate and EX-OR Gate logic.

6. **Attempt any TWO of the following:** **12**

a) Draw ladder diagram for ON and OFF of lamps for the following conditions.

i) START push button switch ON Green and RED Lamp and

ii) STOP push button switch OFF Green Lamp first and after 20 seconds Red Lamp

b) Derive transfer function for the system given in Fig. No. 3 and find damping factor(z) and damped frequency of oscillations (w_n) if R = 1Ω, C = 1F and L = 1H.
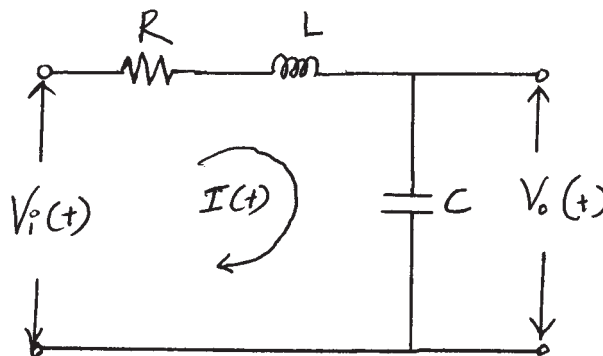

Fig. No. 3

c) Define stability and sketch root locations in s-plane for stable system, unstable system and critically stable system.

————